Posters

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Note: only the first author of each poster is given below

1) Miss. Samira Alharbi

Probing the true nature of Mira's companion

Binary companions to Asymptotic Giant Branch (AGB) stars are an important aspect of their evolution. Few AGB companions have been detected and in most cases it is difficult to distinguish between main-sequence and white dwarf companions. Detection of photometric flickering, a tracer of compact accretion disks around white dwarfs, can help identify the nature of these companions. In this work, we searched for flickering at very low timescales (minutes or less) in the well-known AGB star: Mira. Flickering was detected in all light curves of Mira. We investigated the true nature of Mira's companion using three different approaches. Our results for Mira strongly suggest that its companion is a White dwarf.

2) Prof. Muhammad Akashi

Forming H-shaped and barrel-shaped nebulae with interacting jets

In this work we have modelled planetary nebulae (pne) that have the shape of barrel or H-shape. We assume a binary star in which the companion accretes mass from the wind that was blown from the primary star. An accretion disk is formed around the secondary star and two opposite jets are lunched from it. Indeed, we assume a dense spherical shell was previously formed. The jets interact with dense shell and at later time a barrel-shape/H-shape is obtained. We have conducted the FLASH code to simulate this interaction and got results that can be compared to observations. The simulations were performed with different parameters, in some cases the radiative cooling is on and in others it is off.

3) Miss. Abeer Almutairi, PhD student

The radio evolution of planetary nebulae

Planetary nebulae are formed when an old star ejects its outer layers in a catastrophic wind. The ejecta expand away from the star, and become ionized by the rapidly heating star. Eventually, the star fades to become a white dwarf while the nebula disperses and merges with the interstellar medium. This is the fastest phase of stellar evolution. The planetary nebula may live for only 10 thousand years and in a few cases, nebulae have been seen to evolve within a few years. This project will look for evidence of rapid evolution in radio images of planetary nebulae. It will use new data from the e-Merlin and the VLA radio telescopes, to create high-resolution images that will be compared to images taken 20 years ago. This will reveal the expansion of the nebulae, and reveal for the first time the three dimensional expansion patterns. The results will be used to improve stellar and nebular evolutionary models.

4) Dr. Ivan Bojicic, post-doctoral fellow

The Hong Kong/AAO/Strasbourg H-alpha Planetary Nebula Database

The Hong Kong/AAO/Strasbourg H-alpha Planetary Nebulae database is an online tool providing free and easy access to the largest and most comprehensive catalogue of known Galactic PNe, and to a repository of observational data (imaging and spectroscopy) for these and related astronomical objects. The main motivation for creating this system is resolving some long-standing problems in the field e.g. problems with mimics and dubious and/or mis-identifications, errors in observational data and consolidation of the scattered data. This tool allows researchers quick and easy access to the archived and new observational data and creating and sharing on non-redundant PN samples and catalogues.

5) Dr. Xuan Fang, post-doctoral fellow

Deep Spectroscopy of Planetary Nebulae in Halo of M31

In order to study the substructures of extended halo of the nearby large spiral system, the Andromeda Galaxy (M31), we carried out deep optical spectroscopy using the 10.4m GTC. I will present the results.

6) Miss Vana Fragkou, PhD student

A Search for Galactic Planetary Nebulae Using Multi-wavelength Data

Starting with the Cornish radio catalog and using supplementary multi-wavelength data, we uncovered 62 new Planetary Nebula (PN) candidates. Multi-wavelength diagnostics applied to these objects further predicted their PN nature. Only 11 of these candidates have optical detections, which are required for their spectroscopic follow-up and from the 8 of these that have already been observed spectroscopically the 7 have been proved to be True PNe (87.5% of the sample tested). At least 6 of these new discoveries are Type I PNe partly because of the coverage of the Cornish catalogue close to the galactic equator, where they are relatively common. Our results highly support the usage of multi-wavelength data for the search of Galactic PNe, particularly of these of Type I chemistries, whose dusty environments often limit their searches in optical wavelengths.

7) Dr. Denise R. Golçalves, Assoc. Professor

On the distance to expansion nebulae using the distance mapping technique – DMT

Diverse dynamic astrophysical objects as planetary nebulae (PNe), nova and supernova remnants and the stellar ejecta of luminous blue variables, among others, show radial expansion. An accurate distance determination is needed, since it is an essential parameter for deriving their physical characteristics, such as size, mass, luminosity and age. An innovative technique based on the expansion parallax method – the distance mapping technique, DMT – was recently proposed. It combines tangential velocity vectors from 3D morpho-kinematic SHAPE models and observed proper motion vectors to estimate the distance (Akras & Steffen 2012). The DMT has been updated and used in this work to calculate the distance of four PNe (NGC 6702, NGC 6543, NGC 6302 and BD 30 3639), one nova remnant (Gk Persei) and for the stellar ejecta of η-Car. New morpho-kinematic SHAPE models were generated for NGC 6543 and NGC 6302 and published models were used in the other cases. Preliminary results for NGC 6302, GK persei and the stellar ejecta of η-Car are presented in this contribution. In general our DMT maps determine distances that are consistent with previous studies

8) Dr. Denise R. Gonçalves, Assoc. Professor

A systematic search for Galactic halo PNe using 3 narrow- and broad-band imaging surveys

From the approximately 3000 PNe discovered in our Galaxy, only 14 are found to be members of the halo. In the past, colour-colour diagrams based on Hα and broad-band images were used to find PNe. Nevertheless, a systematic search for halo PNe (HPNe) was never done. In this contribution we present techniques to identify HPNe in the Galaxy, by using the Javalambre-Physics of the Accelerating Universe Astrophysical Survey (J-PAS) and J-PAS related surveys, J-PLUS[1] and S-PLUS[2]. These surveys' advantage is their great combination of narrow- and broad-band filters, in total, 56, 12 and 12 respectively. The limiting magnitude of [O III] in J-PAS is ~22, while the depth of the Hα images in J-PAS, J-PLUS and S-PLUS are, respectively, ~23, ~21 and ~21. Therefore, the characteristic strong emission lines and low continuum of the HPNe can be easily detectable by these surveys. The spectra of several types of sources, which were convolved to the three photometric systems, were used with the principal component analysis to find adequate combinations of colours to discriminate HPNe from other emission line objects. Thus, we have developed new colour-colour diagrams that delimit the HPNe region, separating them from their contaminants such as symbiotic stars, star-forming galaxies, cataclysmic variables, QSOs and extragalactic H II regions. Our techniques were proven robust by the J-PLUS observation of a couple of known HPNe, which turn out to be well located in the delimited regions. New HPN candidates, selected in the J-PLUS and S-PLUS Early Data Release, will be discussed in this contribution

9) Dr. Todd Hillwig, Assoc. Professor

The Kepler K2 Survey of Planetary Nebula Central Stars

We present preliminary results of our program to monitor all planetary nebula central stars in the Kepler K2 fields. Our observations include targets from Campaigns 0, 2, 7, and 11 with nearly 200 total central stars observed. We give a preliminary observed binary ratio, potential biases in that value, and discuss other results based on our current analysis of the data. We also describe difficulties in interpreting the K2 data for these systems and how we are addressing those issues.

10) Dr. Chih-Hao Hsia

Discovery of New Planetary Nebulae selected from LAMOST Database

We report a multi-wavelength study of new planetary nebula (PN) candidates selected from the Large Sky Area Multi-Object Fiber Spectroscopic Telescope (LAMOST) database. We present low/mid-resolution optical spectra of these PNs. The PN status of our sample was confirmed by optical narrow-band images and their low/mid-resolution spectra. Based on the locations of these objects in log (H-alpha/[N¢ſ]) versus log (H-alpha/[S¢ſ]) diagnostic diagram, we conclude that two of them are PNs. The optical and infrared appearances of these newly discovered PNs are discussed. Furthermore, we derive the dynamical ages and distances of these nebulae and study their spectral energy distributions (SEDs) with extensive infrared archival data.

11) Mr. Alexander Jones, PhD student

K-band spectroscopy of new optically-obscured planetary nebula candidates

The recently completed imaging survey of the Galactic Plane (GP) for extended molecular hydrogen emission-line sources (the UWISH2 survey), has detected over 33,000 individual H2 features. On the basis of morphology and lack of association with known star-forming activity, 170 previously unreported objects have been identified, which are likely to be new planetary nebulae (PN). More than 90% of these candidates do not appear in Hα emission-line surveys, such as IPHAS or SHS. We have obtained LIRIS/WHT K-band long-slit spectroscopy of a sample of these objects, many of which belong to the optically-obscured PN population, to confirm their nature and determine excitation and evolutionary status. These objects are strong H2 emitters with bipolar morphologies, and their low latitudes ($|b| < 2°$) mean their progenitors are possibly more massive. A multitude of ro-vibrational transitions of H2, along with recombination lines of H (Brγ) and He are seen. We find the majority of our sample is likely to be true PN, while a few are potentially proto-planetary nebulae (PPN), with no detectable Brγ emission. We measure the 2-1 S(1) to 1-0 S(1) H2 emission line ratio of our targets, and find this is often greater than 10, implying shock excitation is dominating. These results, along with future narrow-band imaging and IFU spectroscopy observations, will provide the parameters essential for modelling the interaction between the ionized and molecular regions, and hopefully shed light on the little-known optically-obscured GP PN population.

12) Mr. Matthias Kronberger, Amateur

Medium- to large-sized planetary nebulae and candidates from the DSH sample

Within the framework of the Deep Sky Hunters (DSH) project, almost 300 true, probable and possible planetary nebulae (PNe) have been identified over recent years by amateur astronomers by visually scanning various publicly available digital resources from the UV to the infrared regime [1-4], and incorporated them into the Hong Kong/AAO/Strasbourg Hα planetary nebula database [5]. This contribution provides an overview of medium- to large-sized PNe and candidates discovered within our survey (optical diameter >2 arcmin), including several new objects. Many of the discussed specimens are likely to belong to the group of Local Volume ($d < 1$ kpc) or Extended Local Volume ($d < 2$ kpc) PNe. We discuss the properties of the nebulae and their central stars and reflect on their distribution throughout the Milky Way. [1] G. H. Jacoby et al., PASA 27, 156 (2010)[2] M. Kronberger et al., IAUS 283, 414 (2012)[3] M. Kronberger et al., APN VI Conf. Proc, 48 (2014)[4] M. Kronberger et al., JPhCS 728, 7, 2012 (2016)[5] Q. A. Parker et al., JPhCS 728, 3, 2008 (2016)

13) Prof. Sun Kwok

Relationship between stellar and solar system organics

Complex organics synthesized in planetary nebulae show strong spectral resemblance to organics found in meteorites, comets, asteroids, interplanetary dust particles, and planetary satellites. We suggest that the stellar and solar system organics have a common origin, and the primordial solar system had been chemically enriched by stellar ejecta. The possibility that the primordial Earth may have incorporated remnants of stellar organics is discussed

14) Dr. Gerardo Ramos-Larios, Assoc. Professor

New morpho-kinematical study of the bipolar planetary nebula NGC 650-51

Deep high-resolution broad- and narrow-band optical images of NGC650-51 expose the rich and intricate fine-structure of this bipolar PN, with “cometary”; knots and small-scale bubble-like features and collimated outflows. A SHAPE spatio-kinematical model indicates that NGC650-51 has a broad central torus with an inclination angle of 75 degrees with respect to the line of sight, whereas that of the bipolar lobes, which are clearly seen in the position-velocity maps, is 85 degrees. Large field of view deep images show, for first time, an arc-like diffuse envelope in low- and high-excitation emission lines located up to 180 arcsec towards the East-Southeast of the central star, well outside the main nebula. This morphological component is confirmed by Spitzer MIPS and WISE infrared imaging, as well as by long-slit low- and high-dispersion optical spectroscopic observations. HST images of NGC650-51 obtained at two different epochs (14 years apart) reveal the proper motion of the central star along this direction. We propose that this motion of the star through the interstellar medium compresses the remnant material of a slow Asymptotic Giant Branch wind, producing this bow-shock-like feature.

15) Dr. Gerardo Ramos-Larios, Assoc. Professor

Hidden reservoirs of molecular hydrogen gas in PNe

A significant fraction of PNe has been found to possess structures in much smaller scales than the nebula itself. These structures are brighter in low-ionization lines (e.g. [NII], [SII], [O I]; the low-ionization structures, LIS) than the surrounding medium, making them easily perceptible via narrow-band imaging on these lines. However, their formation mechanisms are still poorly understood. Electron densities of LISs have been found to be lower than that of the surrounding nebular gas, despite they have the same chemical composition that is noticeably inconsistent with the predictions of the proposed formation model. We present the deepest near-IR images and report the first detection of molecular hydrogen emission from LISs in two PNe. Surprisingly they have opposite morphologies and ages, being K 4-47 young and bipolar, while NGC 7662 is much older and elliptical. These findings contradict the usual detection of H2 in bipolar PNe, and provide insights to the formation of LISs.

16) Dr. Thomas Rauch, Head of administration

Jurassic World: The Decline of the Blackbody

Since more than a decade, the German Astrophysical Virtual Observatory (GAVO) provides the registered Virtual Observatory (VO) service TheoSSA (Theoretical Stellar Spectra Access, http://dc.g-vo.org/theossa).It is dedicated to the easy access of VO users to theoretical stellar spectral energy distributions (SEDs). These include non-local thermodynamic equilibrium model-atmosphere fluxes for hot, compact stars like, e.g., central stars of planetary nebula. These SEDs replaced the coarse blackbody approximation for central stars, that had been commonly used in the last century and beyond, because reliable ionizing fluxes are mandatory for precise nebula analyses. We demonstrate TheoSSA's model-SED-on-demand abilities in operation.

17) Dr. SeyedAbdolreza Sadjadi, Post-doc

The Reliability of Density Functional Theory in Studying Complex Organic Molecules in Planetary Nebulae

Density functional theory is one of the most widely used quantum chemistry models to study the structure, thermodynamic and spectroscopic properties of organic molecules. This is mostly because it delivers reasonable computational time to partially recover the electronic correlation energy in small(5-10 carbon atoms) to large (150 carbon atoms) size molecules. The concern is finding the correct combination of functionals and basis sets among the long list of each of them to accurately solve the problem at hand, is a tedious task. Here the accuracy and reliability of two functionals, namely B3LYP and BHandHLYP which are used in our works in reproducing the infrared spectrum of different classes of organic molecules are presented.

18) Dr. Toshiya Ueta, Assoc. Professor

Galactic Planetary Nebulae Detected in the AKARI Far-IR All-Sky Survey Maps

The AKARI Infrared Astronomical Satellite produced the AKARI far-IR all-sky survey (AFASS) maps at roughly arc-minute spatial resolution, enabling us to investigate the whole sky in the far-IR for objects having surface brightnesses greater than a few to a couple of dozen MJy/sr. While the AFASS maps are absolutely calibrated against large-scale diffuse emission, it was uncertain whether an additional flux correction for point sources was necessary or not. We have verified that point-source photometry using the aperture correction method based on the empirical point-spread-function templates derived directly from the AFASS maps reproduces fluxes in the AKARI bright source catalogue (BSC) without any additional correction. This means that far-IR photometry of any (extended) sources can be done by summing all the pixel values within an appropriately defined boundary of the intended targets in the AFASS maps. We then carried out photometric measurements for Galactic planetary nebula provided by the HASH PN database, establishing far-IR fluxes for 1321 Galactic PNe including a few hundreds of additional PNe not listed in the BSC. A comparison between presently derived and BSC catalogue fluxes of these PNe suggest that direct aperture photometry with the AFASS maps should be done to obtain more accurate fluxes for sources that are not necessarily point sources.